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(56) Documents cited

GB 2036631 A

(58) Field of search

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(54) Dry shaver

(57) A dry shaver has its shaver head (10) mounted for rocking about an axis which is substantially perpendicular to the longitudinal axis of the head (10) and lies on or above an upper surface of the shaving foil (53) of the head.

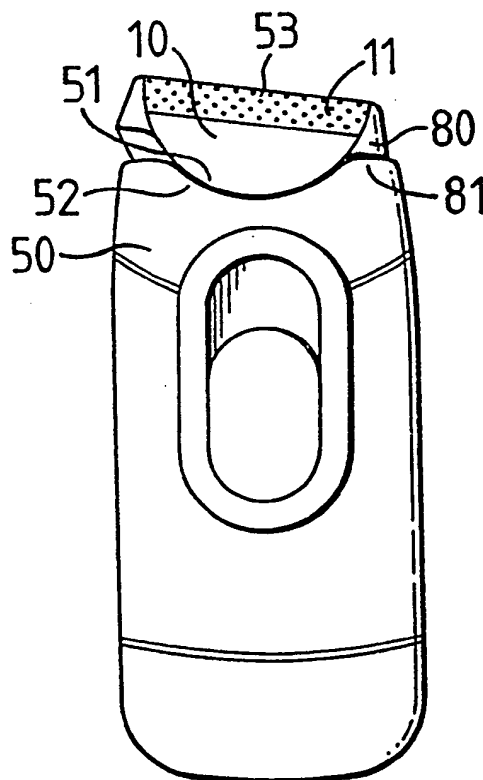
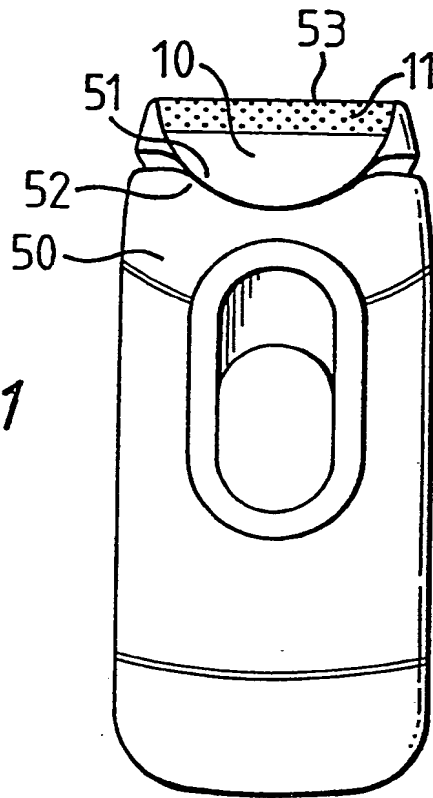


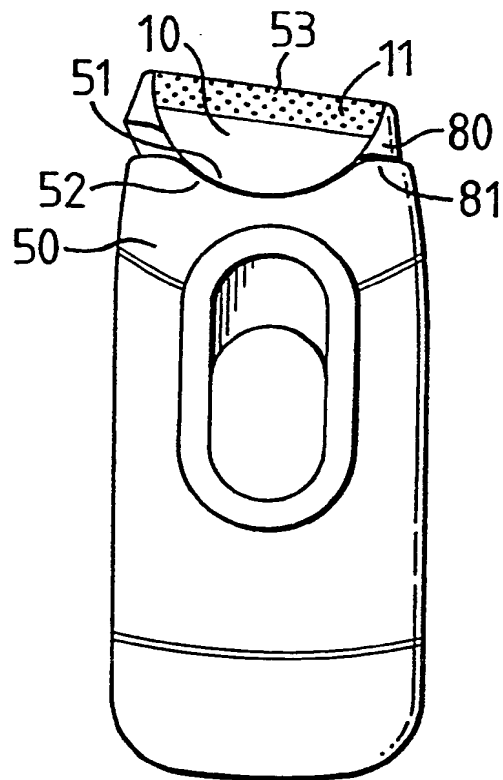
FIG. 2

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*FIG. 1*



*FIG. 2*

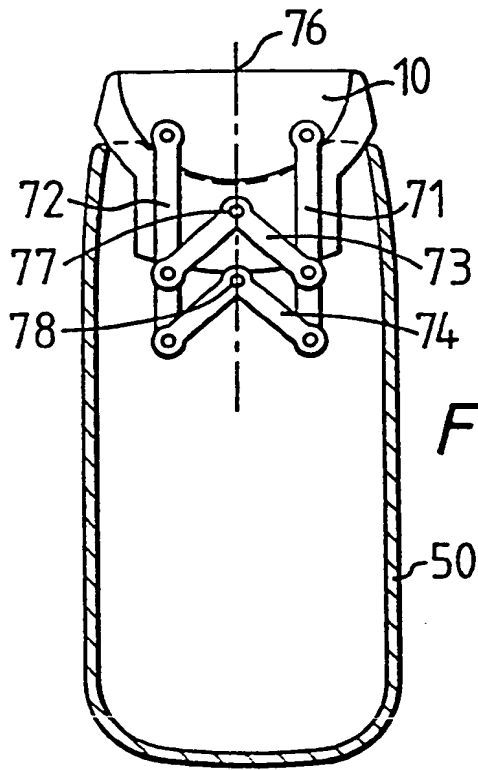


FIG. 3

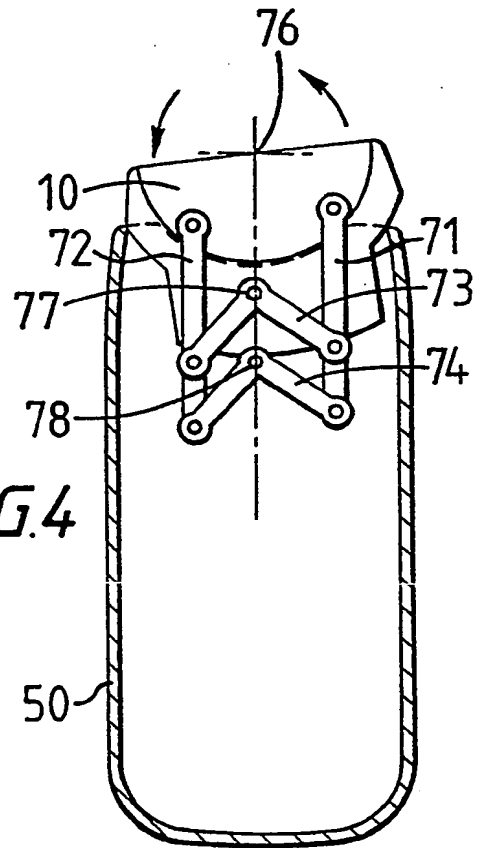


FIG. 4

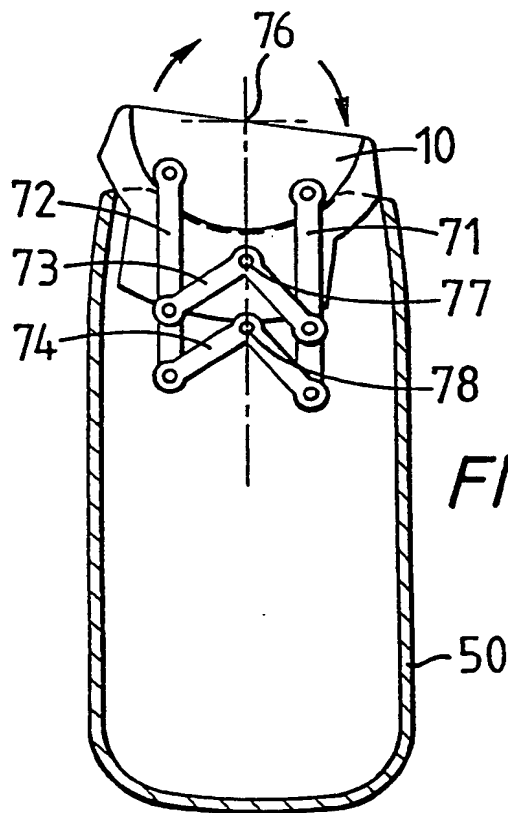


FIG. 5

FIG. 6A

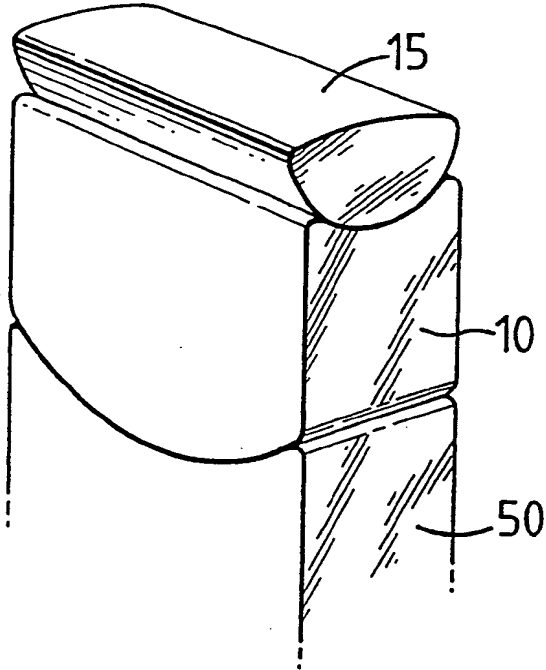


FIG. 6B

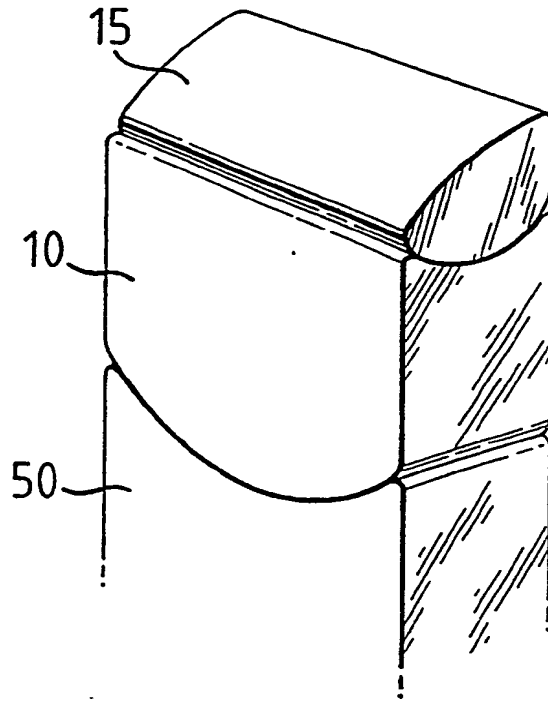


FIG. 6C

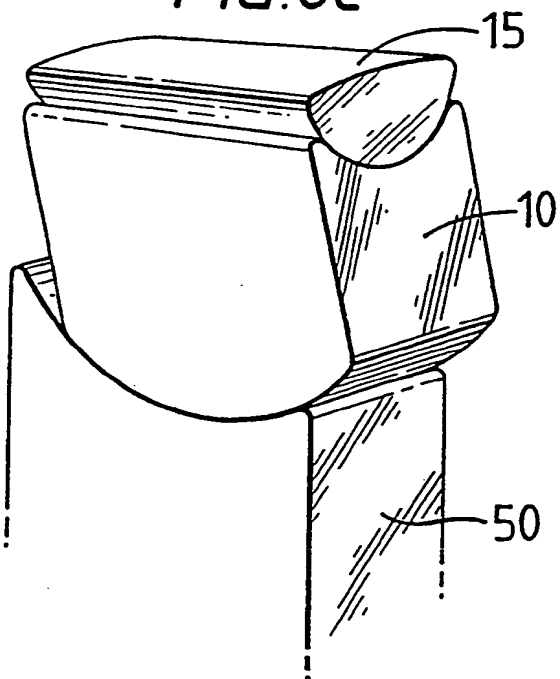
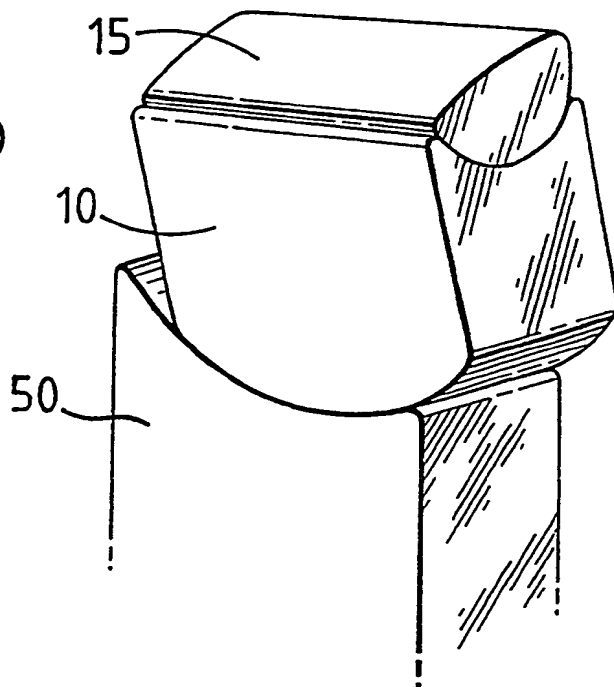
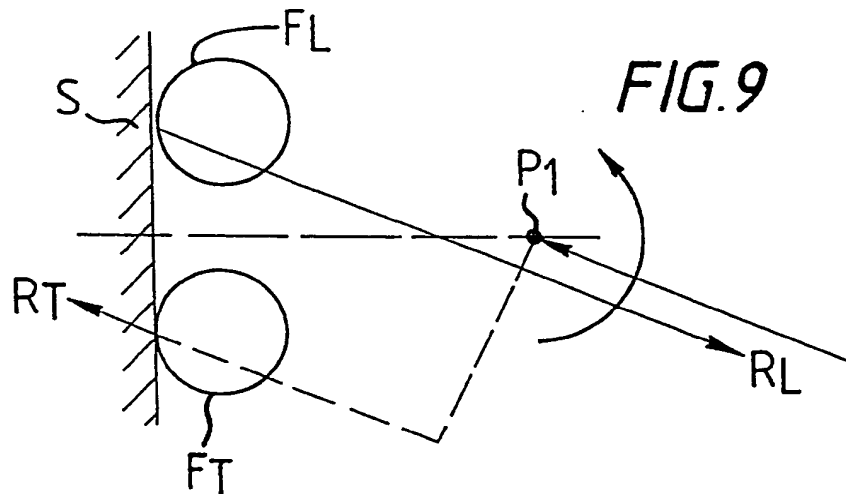
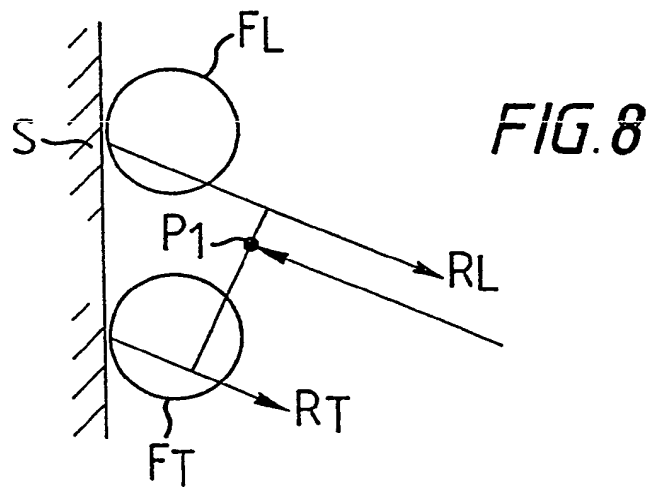
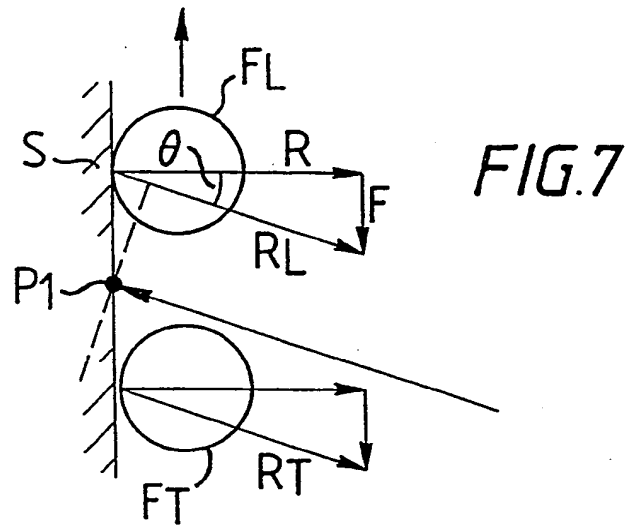
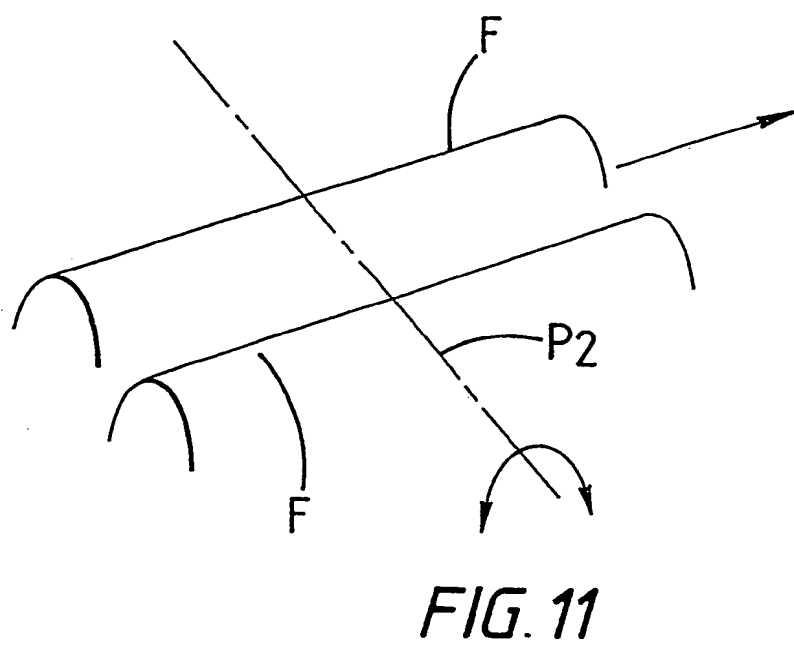
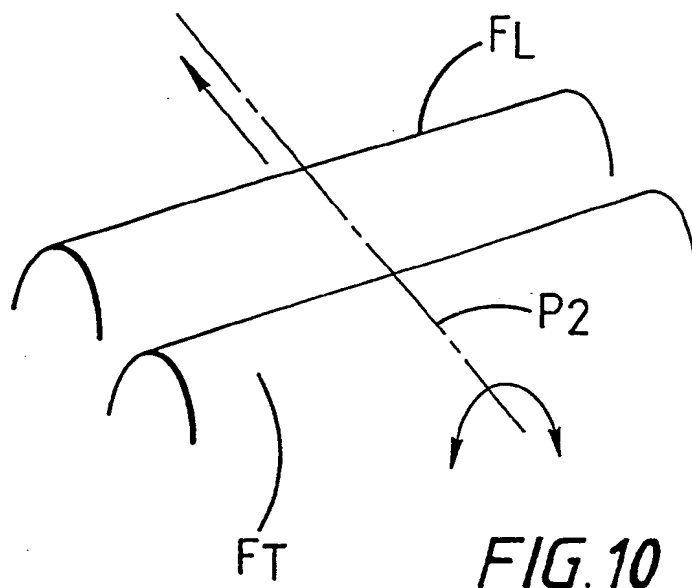


FIG. 6D







DRY SHAVER

5           This invention relates to a dry shaver comprising:

          a shaver body;

          an elongate shaver head, mounted on said  
10 shaver body, and removable for cleaning or replacement and comprising a shaving unit having at least one open-bottomed shaving foil;

          an inner cutter mounted inside the foil and subject to a biasing force which maintains the inner  
15 cutter pressed into contact with the foil to achieve a shaving action with the foil;

          drive means to provide cutter movement; and

          means for mounting said shaver head to enable  
20 rocking relative to the shaver body about a rocking axis which is substantially perpendicular to the longitudinal axis of the head.

          A shaving unit may comprise a foil, an associated inner cutter, and means for coupling to  
25 the drive means for providing cutter movement.

          A dry shaver of this type is described in  
JP-A-53 106 256. This shows a mechanism in which the  
30 shaver head is mounted using a pair of springs at each end which press the head upwards against an upper flange of the shaver body. This flange is curved so that the head is substantially constrained to tilt about a centre of rotation which is situated towards the centre of the shaver body.

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In this device, the springs give the shaving unit some resilience so that it can maintain better contact with the surface to be shaved. However, there is also considerable resistance to any sideways component or tilt component of the movement of the shaver head. This occurs because the springs are orientated such that their main component of force is in a vertical direction, normal to the surface to be shaved, and any tilting of the shaver head has a vertical component of motion at either end of the shaver head which therefore meets considerable resistance from the spring at the end of the shaver head which is depressed. Accordingly, such a construction provides only a limited degree of orientation correction when pressed against the surface to be shaved. If the springs are made weaker in order to facilitate tilting, there may be insufficient force to press the shaver head against the arched flanges of the shaver body and therefore the tilting effect may be lost.

GB-2-036 631 shows a similar device with the shaver head constrained to tilt about a peg in the centre of the head, with each end of the head pressed upwards by spring members. No fixed pivot point is however defined by this mechanism. Still less can a virtual pivot be positioned at a desired location.

It is one object of the present invention to provide a dry shaver with improved capacity for adaptation to facial contours during shaving.

According to one aspect of the invention, a dry shaver of the type initially defined above is characterized in that said rocking axis lies either on or above an upper surface of the foil.



By so locating the rocking centre, a reactive rotating action is established, which gives improved freedom of movement of the shaver head.

5           Advantageously, the mounting means provides a virtual pivot.

          Preferably, the mounting means comprises a parallelogram linkage.

10           According to another aspect of the invention, the dry shaver initially defined above is characterized in that said mounting means comprises a parallelogram linkage.

15           The linkage can in a preferred embodiment comprise two opposed limbs and a pair of transverse link members, pivotably attached to said opposed limbs and to the shaver body. Further, the  
20           transverse link members can preferably be constituted by respective bell-crank levers.

          Shaver heads frequently comprise multiple shaving units. The invention is applicable to  
25           multi-head dry shavers provided with a swivel action. Advantageously, the shaver head may also be rockable about an axis parallel to the longitudinal axis of the head. Preferably, the rocking about this axis is about a centre which lies on or below the  
30           surface to be shaved.

          Optionally, the rocking motion of the shaver head or heads is damped.

35           The inner cutter may be mounted for reciprocatory movement along the axis of the associated foil under the effect of said drive means.

The invention is also applicable to dry shavers of the type in which the inner cutter rotates beneath an outer foil.

5 For a better understanding of the invention, and to show more clearly how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

10 Fig. 1 is a side view of an embodiment of the invention viewed perpendicularly to the axis of the foil, and with the shaver head in a central position;

15 Fig. 2 shows the dry shaver of Fig. 1 with the shaver head in one extreme position;

20 Fig. 3 shows schematically viewed along an axis perpendicular to the foil axis, a linkage arrangement for use in the dry shaver of Fig. 1, in a central position;

Fig. 4 shows a similar view of the linkage of Fig. 3 in one extreme position;

25 Fig. 5 shows a similar view of the linkage of Fig. 3 in the extreme position;

30 Figs. 6A to 6D show schematic perspective views of a dry shaver having a rockable head in various orientations;

Figures 7 to 9 are schematic representations of a cross-section through a twin-head dry shaver moving over a skin surface; and

35 Figures 10 and 11 are schematic perspective views of a twin-head dry shaver showing the position of a pivot axis.

Referring first to Fig. 1, a shaver head 10 is shown mounted on a shaver body 50. The shaver head 10 includes an open-bottomed arched shaving foil 53 which encloses an inner cutter (not shown). The foil 53 and inner cutter form an elongate shaving unit 11, which cooperates with associated drive means (not shown).

The shaver head 10 rocks on the shaver body 50 by means of a parallelogram linkage to be described hereinafter. The head rocks as a whole about an axis perpendicular both to the longitudinal axis of the foil 53 and to the plane of the drawing. Lower curved surfaces 51 of the head are arranged to clear counter surfaces 52 of the shaver body, closely enough to provide a good seal.

Fig. 2 shows the shaver head 10 in a tilted position rocked to one extreme until a curved end stop surface 80 at one side of the shaver head meets a corresponding end stop surface 81 on the shaver body 50.

The rocking motion of the shaver head is shown to be about a rocking centre which lies either on or slightly above the arched shaving foil 53. The mechanism could also readily position the centre slightly below the foil surface (e.g. about 1 mm below) if desired.

Sufficient rocking motion is allowed before the end stops are reached so that a user does not need to hold the shaver body at a precise angle to achieve optimum contact of the arched foil onto the surface to be shaved.

Figs. 3 to 5 illustrate schematically one type of mounting linkage which enables the desired rocking of the shaver head about a virtual pivot.

The shaver head 10 and shaver body 15 are shown in outline. Fig. 3 shows the shaver head in a central position, and Figs. 4 and 5 show the shaver head in positions displaced anti-clockwise and clockwise respectively.

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In Fig. 3 the shaver head 10 is shown mounted on upper ends of a pair of vertical side members or limbs 71 and 72. The pair of vertical side members 71 and 72 constitutes, in combination with transverse limb members 73 and 74, a four bar parallelogram linkage. Each of links 73 and 74 constitutes a bell-crank lever. Triangular link members may be used instead of bell-crank levers 73 and 74.

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The bell-crank levers 73 and 74 are pivoted at respective pivot points 77 and 78 to fixed points of the shaver body (not shown). These fixed points of the shaver body may be located on a central plane 76 of the shaver. Also, a second corresponding mechanism is provided (not shown) so that one mechanism is provided on each side of the head, with the two mechanisms operating in parallel planes.

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Through this construction, a virtual pivot centre 76 is produced well above the points of attachment of the vertical side members or limbs 71 and 72 to the shaver head 10. The virtual pivot may be located on, below or above skin level depending on the size of the pivoting triangles or bell-crank levers 73 and 74. This may be achieved without the need for a physical upper pivot location.

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The shaver head may comprise two shaving units mounted sided by side as shown in GB 2 036 631 (see Fig. 4 in particular). Each unit can be mounted

so as to move independently of the other in a vertical plane e.g. by rocking.

5 Damping may be provided (not shown) at any of the moving parts of the mechanism. The respective pivot points 77 and 78 may be mounted resiliently (not shown) on the shaver body 50 to enable better contact on the surface to be shaved.

10 A further example of the linkage is described in US Patent No. 4 797 997, which is hereby incorporated by reference.

15 Furthermore, the two pivot points 77 and 78 may be themselves mounted on additional parallelogram linkage to enable rocking of the shaver head about an axis parallel to the axis of the foil as well as rocking about an axis perpendicular to that of the foil.

20 Alternatively, the additional parallelogram linkage mentioned above could be incorporated in the shaver head, to produce a configuration as shown in Figs. 6A to 6D.

25 Each of Figs. 6A to 6D shows a schematic perspective view of a dry shaver having a main body 50, a head 10 and a shaving unit 15. The head 10 is pivotable about an axis perpendicular to the longitudinal axis of the head 15, in accordance with  
30 the detailed description given with reference to Figs. 1 to 5. The head 15, on the other hand, is pivotable about an axis parallel to the longitudinal axis of the head 15 again about a virtual pivot on or below the surface of the skin. A mounting  
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arrangement for the head 15 can be constructed, as mentioned above, using an additional parallelogram linkage in a similar manner to that illustrated in Figs. 3 to 5.

5           It will be appreciated that Fig. 6A shows the head 10 and shaving unit 15 in their respective centralized positions. In Fig. 6B the head 10 remains in its centralized position whereas the shaving unit 15 is rocked to one extreme of its  
10 motion. In Fig. 6C the shaving unit 15 is centralized, whereas the shaving head 10 is rocked to one extreme position. Finally, Fig. 6D shows both the head 10 and the shaving unit 15 rocked to an extreme position.

15           By a construction such as shown in Figs. 6A to 6D, in effect the shaving unit 15 can rotate to any desired orientation relative to the body 50 for effective adaptation to facial contours during  
20 shaving.

          The advantage of locating the rocking centre on or below the surface to be shaved will be described with reference to Figs. 7 to 11.

25           Figs. 7 to 11 relate to the situation occurring with a twinhead razor when the head is being moved over the surface of the skin S. The razor has a leading foil  $F_L$  and a trailing foil  $F_T$  and is moved in a direction perpendicular to the  
30 parallel axes of both foils  $F_L, F_T$  and a virtual pivot  $P_1$ . In simple terms, it shows that when the pivot axis  $P_1$  lies on the surface of the skin (Fig. 7), the reactions  $R_L$  and  $R_T$  generated by each foil are  
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essentially equal. When undulations of the skin surface cause a temporary imbalance in this condition a compensatory rotation of the head about the pivot occurs to restore equal loadings.

5           If the pivot axis  $P_1$  is located above the skin surface  $S$  (i.e. more within the body of the razor (Fig. 8), the reaction  $R_L$  produced at the leading foil  $F_L$  by the forward motion of the razor will be greater than that  $R_T$  occurring at the  
10 trailing one. Thus, assuming the direction of the reaction at the leading foil  $F_L$  does not fall inside the pivot axis (i.e. if the axis is positioned too deeply within razor body or if excessive friction occurs at leading foil (Fig. 9)), both foils will  
15 remain in sliding contact with the skin surface, the leading foil experiencing the greater proportion of the applied load. Again, undulation of the skin surface  $S$  will result in head rotation in an attempt to maintain the equilibrium of the differentially  
20 biased foils. However, if skin preferentially "builds-up" in front of the leading foil  $F_L$  (owing to the larger reaction force being experienced), the direction of the reaction on this foil will change and may fall inside the pivot axis (unless prevented  
25 by other restoring means), resulting in undesirable head rotation and consequent lifting of the trailing foil from the skin surface.

          Conversely, if the pivot axis  $P_1$  is located  
30 below the skin surface, the reaction  $R_T$  produced at the trailing foil becomes the greater, producing similar effects to those discussed above, but in the opposite sense. Again, to avoid head instability, it is important to ensure that the pivot axis  $P_1$  is not  
35 positioned too far below skin level or to allow the direction of the reaction force produced at the

trailing foil to fall inside the pivot axis. Thus, in theory, an undesirable head rotation may occur if the pivot axis placed either too high above the skin surface, or too deeply within - the actual distances not necessarily being the same.

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As the razor head is moved over the skin surface there will be a natural tendency for skin to "build-up" ahead of each of the two foils. The presence of the skin bulge ahead of the leading foil will increase the reaction produced at this foil. The skin bulge ahead of the trailing foil will result in a similar effect on this foil, leaving, for equivalent bulges, no net effect on the "equilibrium" of the razor head. However, because the "gap" between the two foils is so narrow, the skin surface in this area may also come into contact with the trailing surface of the leading foil to increase further the reaction on this component. Thus, overall, there is likely to be a net increase in the reaction occurring at the leading foil. By arranging for the pivot axis to be positioned just below skin surface level, equal reactions on both foils can be achieved.

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The main emphasis of this application relates to the alternative, co-planar direction of head rotation (Fig. 10) where the pivot axis  $P_2$  is perpendicular to that of the foil. Free rotation of the razor head about this axis - as the razor is moved over the undulating skin surface in a direction substantially parallel to the pivot axis  $P_2$  - will allow the head to adopt the most appropriate alignment without the need to adjust or correct the angle at which the razor is held. Because the length



of the head/foil assembly is several times greater than the preferred physical separation between adjacent foil pairs, head stability about this axis will be much more controllable and much less sensitive to its positioning (relative to skin level) than is the case for the first co-planar axis. Again, a virtual pivot axis  $P_2$  located just beneath skin level is the preferred position.

If, on the other hand, the razor is drawn "sideways" (Fig. 11) over the skin surface (i.e. in a direction parallel to the foil axis), similar arguments to those made for the first axis direction will apply. However, because each foil is presented to the skin at a different attitude (i.e. single linear rather than double arcuate contact), other considerations may need to be addressed. For example, skin build-up ahead of the leading edge of the foil or foil frame assembly, and uneven skin contact along the length of the foil will affect head equilibrium. To reduce the risk of head instability in the former case, the pivot axis should again be positioned just below the skin surface. The latter consideration gives rise to a variable effect on the positioning, magnitude, and direction of the foil reaction vector, which depends on the location and extent of the major area of skin-to-foil contact (along the length of the foil) relative to the pivot axis. Overall, a mean position for the pivot axis just below the skin surface is appropriate.

It should be noted that all references to the positioning of the pivot axis relative to the skin surface relate to the mean level of the skin surface in contact with the foil. In the gap between the two

foils, skin "bulging" will occur to make the pivot axis appear deeper beneath the skin surface than the effective position.

5           A further advantage of the virtual pivot is that no protruding pivot portion of the shaver body is necessary, at the sides of the shaver, which would otherwise hinder the shaving operation.

10           The individual shaving units may either be of the type described in US Patent No. 4 797 997, or may be of the "integrated" type illustrated in our co-pending UK application no. 9127102.3 (our ref: P10518) in which the whole unit is removable from the  
15           shaver body.

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CLAIMS:

1. A dry shaver comprising:  
5 a shaver body;  
an elongate shaver head, mounted on said shaver body, and removable for cleaning or replacement and comprising a shaving unit having at least one open-bottomed shaving foil;  
10 an inner cutter mounted inside the foil and subject to a biasing force which maintains the inner cutter pressed into contact with the foil to achieve a shaving action with the foil;  
drive means to provide cutter movement; and  
15 means for mounting said shaver head to enable rocking relative to the shaver body about a rocking axis which is substantially perpendicular to the longitudinal axis of the head, characterized in that said rocking axis lies either on or above an upper  
20 surface of the foil.
2. A dry shaver according to claim 1 wherein said mounting means provides a virtual pivot.
- 25 3. A dry shaver according to any preceding claim wherein said mounting means comprises a parallelogram linkage.
- 30 4. A dry shaver comprising:  
a shaver body;  
an elongate shaver head, mounted on said shaver body, and removable for cleaning or replacement and comprising a shaving unit having at least one open-bottomed shaving foil;  
35 drive means to provide cutter movement; and

means for mounting said shaver head to enable rocking relative to the shaver body about a rocking axis which is substantially perpendicular to the longitudinal axis of the head, characterized in that:

5       said mounting means comprises a parallelogram linkage.

5.       A dry shaver according to claim 4 wherein said mounting means provides a virtual pivot.

10       6.       A dry shaver according to any of claims 3 to 5 wherein said linkage comprises two opposed limbs and a pair of transverse link members, pivotably attached to said opposed limbs and to the shaver body.

15       7.       A dry shaver according to claim 6 wherein said link members are constituted by respective bell-crank levers.

20       8.       A dry shaver according to any preceding claim wherein said shaver head comprises two or more shaving units, attached to each other, or independently mounted.

25       9.       A dry shaver according to any preceding claim comprising two or more independently mounted shaver heads.

30       10.       A dry shaver according to any preceding claim wherein the shaver head or shaver heads is/are also rockable about an axis parallel to the axis of the head.

35       11.       A dry shaver according to claim 10 wherein the rocking about the axis parallel to the axis of the head is about a rocking centre which lies on or below the surface to be shaved.

12. A dry shaver according to any preceding claim further comprising means for damping the rocking motion of the shaver head or heads.

5 13. A dry shaver according to any preceding claim wherein each inner cutter is mounted for reciprocatory movement along the axis of the associated foil under the effect of said drive means.

10 14. A dry shaver according to any preceding claim wherein said means for mounting said shaver head or said means for mounting said shaver unit is resilient to forces substantially normal to the surface to be shaved.

15 15. A dry shaver substantially as hereinbefore described with reference to the accompanying drawings.

20 16. Any novel feature or combination of features of the dry shaver hereinbefore described.

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Patents Act 1977

Examiner's report to the Comptroller under  
Section 17 (The Search Report)

Application number

9208022 5

Relevant Technical fields

- (i) UK Cl (Edition K ) B4B (B41, B42, B46B)
- (ii) Int CL (Edition 5 ) B26B (19/00, 19/04, 19/10)

Search Examiner

J A MULLEN

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

11 JUNE 1992

Documents considered relevant following a search in respect of claims

1-3, 8-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2036631 A (GILLETTE) (acknowledged)	1

SF2(p)

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Category	Identity of document and relevant passages	Relevant to claim(s)

#### Cat gories of documents

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